

## An Isolated Population of *Homoeocarabus maeander* (Coleoptera, Carabidae) Discovered from a Palsa Bog on the Daisetsu-zan Mountains in Hokkaido, Northeast Japan

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**Abstract** An isolated population of *Homoeocarabus maeander* is recorded from a palsa bog on the Daisetsu-zan Mountains in central Hokkaido, Northeast Japan, and is described as a new subspecies under the name *nobukii*.

*Homoeocarabus maeander* FISCHER VON WALDHEIM is a single component of the genus *Homoeocarabus* REITTER belonging to the division Hemicarabigenici of the subtribe Carabina (sensu IMURA, 2002). The species prefers cold marshy environment, and is rather widely but sporadically distributed mainly in the subarctic zone of northeastern Eurasia and northern North America. In Japan, it is endemic to Hokkaido and has been recorded from moors or marshy meadows now discontinuously extant in the low altitudinal area of the same island. It was therefore unexpected that a population of the same species was discovered from the alpine zone of the Daisetsu-zan Mountains, the central massif of Hokkaido.

Early in the summer of 2003, Nobuki YASUDA visited an alpine bog lying at the southern side of Mt. Hira-ga-daké (=Hira-ga-také) in the central part of the Daisetsu-zan Mountains for investigating soil beetles.<sup>1)</sup> The bog is peculiar in accompanying palsa, a peaty permafrost mound, and such a palsa bog is known so far only from there in Japan. Together with *Aulonocarabus kurilensis daisetsuzanus* KÔNO and several other small Carabidae such as *Pterostichus subrugosus* STRANEO, both of which are restricted to the wind-blown community of the alpine zone of the Daisetsu-zan, he found a series of *H. maeander* in pitfall traps set in the bog, and they were submitted to me for study. All the specimens looked so strange in having a smaller size and darker coloration, and apparently distinguishable even with the naked eyes from the other populations of the same species known from Hokkaido which are represented by subsp. *paludis* GÉHIN. After a close examination, it has become apparent that the Daisetsu-zan population bears several other characteristic features of its own, and can be distin-

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guishable not only from subsp. *paludis* but from all the known races of *H. maeander*. I will therefore describe it as a new subspecies in the following lines.

The abbreviations used in the text are the same as those explained in my previous papers.

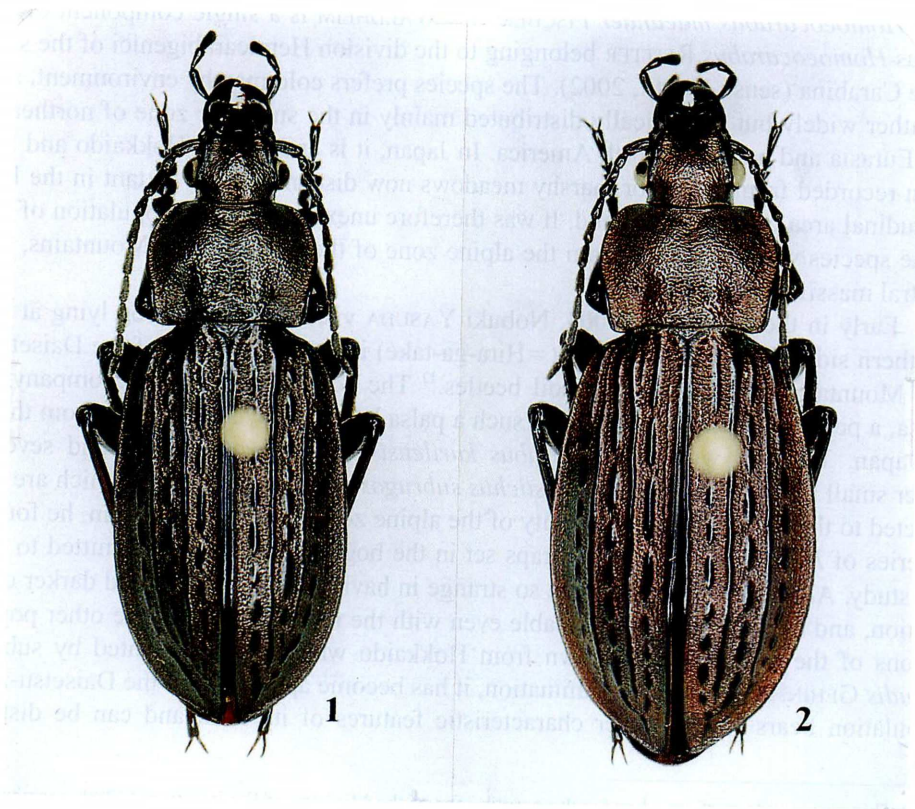
***Homoeocarabus maeander nobukii* IMURA, subsp. nov.**

[Japanese name: Takané-sesujiakagané-osamushi]

(Figs. 1–3)

Length: 17.7–20.3 mm (including mandibles). Body above dark reddish coppery, dark brown or black with a coppery lustre, sometimes with a faint greenish tinge on the lateral sides of head, pronotum and elytra. Venter and appendages black.

Most closely allied to subsp. *paludis*, but readily discriminated from that race in the following respects: 1) size a little smaller on an average; 2) dark individuals are relatively frequent (of the total 23 specimens examined, 13 are dark reddish coppery and



Figs. 1–2. *Homoeocarabus maeander nobukii* subsp. nov. (1, ♂, holotype; 2, ♀, paratype) from a palsa bog near Mt. Hira-ga-daké.

10 are dark brown or black with a coppery lustre), whereas they are much less frequent in subsp. *paludis*; 3) dorsal surface of mandibles more sparsely and weakly punctured; 4) antennae shorter, barely reaching basal fifth of elytra in male, while they usually reach basal quarter in subsp. *paludis*; 5) marginal setae of pronotum completely lost in all the specimens examined, while two pairs of setae (one median and one basal) are inserted in subsp. *paludis*; 6) basal foveae of pronotum a little shallower; 7) humeral serration of elytra completely lost in all the specimens examined, whereas it is constantly recognized in subsp. *paludis*.

Male genital organ as shown in Fig. 3. Aedeagus slender, weakly bent ventrad near the base, nearly straight and parallel-sided in median portion and gradually bent ventrad towards the apex; apical lobe long and narrow, not faintly convergent near the base as in subsp. *paludis* but almost parallel-sided, its dorsal margin gently arcuate throughout and obtusely rounded at the tip in lateral view; basal edge of membraneous preostium narrowly elongate towards base of aedeagus to form a longitudinal furrow on dorsal wall of aedeagus; OL medium to large-sized, rather wide at the base and bilobed at the tip; ligulum indicated by a well developed patch of pigmented granules; neither BL nor ML developed, though dorsal wall of endophallus apparently inflated near the base; PRE moderately or rather prominently inflated, not bilobed and almost

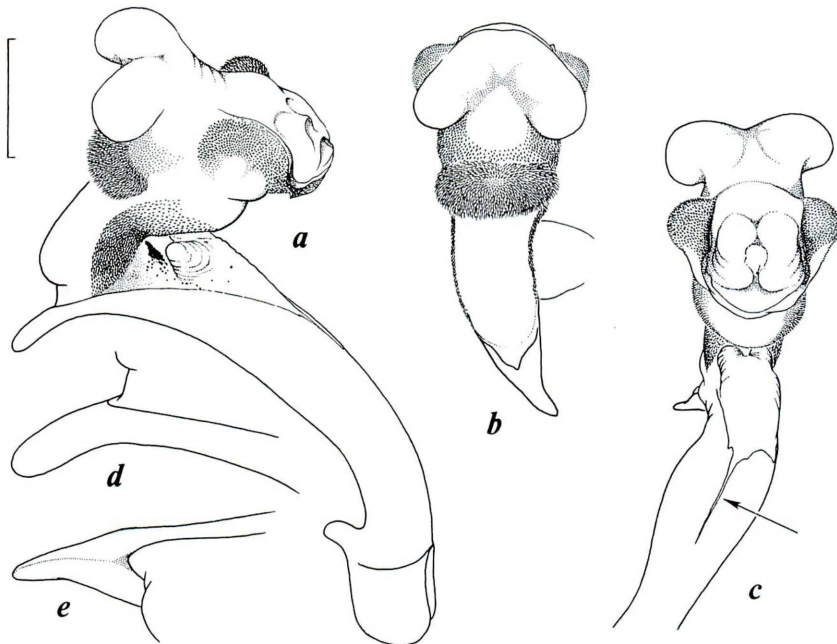


Fig. 3. Male genital organ of *Homoeocarabus maeander nobukii* subsp. nov. — a, Aedeagus with fully everted endophallus in right lateral view; b, ditto in posterior (dorsal) view; c, ditto in frontal (ventral) view; d, apical part of aedeagus in right lateral view; e, ditto in dorsal view. Arrow indicates a membraneous furrow on the dorsal wall of the aedeagus. Scale: 1 mm for a–c; 0.5 mm for d & e.



symmetrical in shape; PP large and bilobed, with each lobe almost symmetrically protruded and rounded at the tip; PAR absent; AL not so large but rather strongly protruded laterad; PL not inflated; AGG unremarkable, neither strongly sclerotized nor pigmented.

*Type series.* Holotype: ♂, palsa bog, at an altitude of 1,720 m, 500–700 m distant to the south from the peak of Mt. Hira-ga-daké, in the central part of the Daisetsuzan Mountains in Central Hokkaido, Northeast Japan, 9–VII–2003, N. YASUDA leg., preserved in the collection of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo. Paratypes: 5♂♂, 17♀♀, same collecting data as for the holotype, in the collections of N. YASUDA and Y. IMURA.

### Discussion

The habitat of the present new subspecies, an alpine bog lying at the southern side of Mt. Hira-ga-daké, is peculiar in accompanying palsa. Palsa is one of the circumglacial landforms distributed in the permafrost zone, indicating a peaty permafrost mound with the height about 0.5 to 10 m and the diameter exceeding about 2 m (WASHBURN, 1983). The palsa bog near Hira-ga-daké was discovered and described for the first time by TAKAHASHI and SONE (1988), and such a landform has not been found so far anywhere else in Japan. According to TAKAHASHI and SONE (1988), it is located on a broad pass on the andesitic lava plateau at an altitude of 1,720 m, measured 650 m from east to west and 350 m from north to south, attaining to about 10.3 ha in area. Average annual temperature at the same site is estimated at about  $-2^{\circ}\text{C}$  (SONE, 2002).

The vegetation in the bog is mainly composed of sphagnum and sedge. Such plants as *Drosera rotundifolia*, *Andromeda polifolia* and *Vaccinium oxycocum* are also dominant, partly associated with *Menyanthes trifoliata* and *Eriophorum vaginatum*. On the other hand, the surface of the palsa is drier than the surrounding bog, and is covered with *Diapensia lapponica* v. *obovata*, *Bryanthus gmelinii*, *Geum pentapetalum* and several kinds of lichens, with a partial invasion of young *Pinus pumila* from the surrounding area (TAKAHASHI & SONE, 1988).

From the botanical point of view, this palsa bog is peculiar in harboring two endemic species; one is a circumpolar sedge, *Carex rotundata* WAHLENBERG (SATO & TAKAHASHI, 1994) and the other is an arctic moss, *Loeskypnum badium* (HARTM.) PAUL (KANDA & SATO, 1994). Both the species are distributed rather widely in the circumboreal to subarctic zones of the Northern Hemisphere, but have been recorded in Japan only from the bog near Hira-ga-daké, and are considered to be a relict of the past cold time.

In view of the carabidology, two species of the subtribe Carabina were obtained from the same bog by pitfall traps. One is *Aulonocarabus* (s. str.) *kurilensis* LAPOUGE (sensu IMURA, 2002, as regards the generic classification) and the other is *Homoeocarabus maeander* FISCHER VON WALDHEIM. The former is represented by subsp. *daisetsuzanus* KÔNO, which is one of the dominant carabids in the wind-blown com-

munity of the alpine zone of the Daisetsu-zan and has hitherto been recorded from the area between Mt. Kuro-daké and Mt. Tomuraushi-yama (YASUDA, 2001). According to YASUDA (pers. comm.), this species was dominant also in the bog, though preferring drier environment. In contrast, the latter was collected from marshy places around the small ponds often associated with the palsas, and seemed to be confined to such a strictly narrow habitat. The Daisetsu-zan population of *H. maeander* is peculiar in several respects and doubtless belongs to a new subspecies as described in the present paper.

In *Homoeocarabus maeander nobukii* nov., all the marginal setae of the pronotum are completely lost and the humeral serrations of the elytra are not recognizable. In addition, the basal edge of the membranous preostium of the male genitalia is narrowly elongate towards the base of the aedeagus to form a longitudinal furrow on its dorsal wall. All these character states are quite exceptional for the species, and are considered to be a unique autapomorphy of the Daisetsu-zan race. This seems to represent either a long history after isolation or a rapid morphological change caused by its distinctive habitat. In many respects, they must have been isolated after the past cold time without mingling with the other population of the same species, and the origin and period of their immigration into Hokkaido might have been different from those of subsp. *paludis* now distributed much more widely in the low altitude moors of the same island.



Fig. 4. Habitat of *Homoeocarabus maeander nobukii* subsp. nov. (palsa bog, 1,720 m in alt., south of Mt. Hira-ga-daké on the Daisetsu-zan Mountains; arrow indicates a palsa; Mt. Hakuun-daké can be seen in the distance) (photograph by N. YASUDA in July 2003).



Since the habitat of the new race is located in the special protection zone of a national nature conservation area, it will be well protected against disturbance caused by collectors. As mentioned in the preceding lines, however, the habitat is narrowly restricted to a small alpine bog which is completely isolated from all the other known localities of the same species. To make matters worse, total area of the palsas has been gradually reducing for the past several decades. For example, they were reduced to about two-thirds (rate of reduction was estimated at 36%) according to the observation made by air photographs taken from 1955 to 1982 (TAKAHASHI & SONE, 1988). Though *H. maeander* is not necessarily depending upon the palsa itself, it seems certain that the climatic changes resulting from the warming of the globe may have an adverse effect on the bog and, in its turn, influence the meager fauna and flora depending on this distinctive environment. From such a point of view, the new race may be worth regarding as a threatened local population.

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### 要 約

井村有希：北海道大雪山のバルサ湿原から発見されたセスジアカガネオサムシの孤立集団。—— セスジアカガネオサムシは、北東ユーラシアから北米にかけての亜寒帯地域を中心に分布する好湿性の種で、わが国においては北海道のみから知られており、これまでに確認された生息地はいずれも低湿地帯ないしそれに準じた環境に限られていた。しかしながら今夏、大雪山層雲峡ビジターセンターの保田信紀氏により、大雪山系中央部の平ヶ岳南方鞍部（標高1,720 m）にある小湿原から、同種の特異な小集団が発見された。同湿原は、永久凍土地帯に分布する周氷河地形のひとつであるバルサ（泥炭質の永久凍土丘）を伴っているという点においてきわめて特異であり、わが国唯一のバルサ湿原として知られている。同地のセスジアカガネオサムシは、氷期以降の比較的長い年月を、他集団との遺伝的交流を絶たれた状態で過ごしてきたことは疑いなく、その進入経路や年代も、道内各地の低湿地に分布している集団とは異なるものかもしれない。形態学的にみても、前胸背板剛毛や肩部鋸齒状突起を欠く点、さらに陰茎

背面に長く亀裂状に伸張する膜状の溝がみられる点など、いくつかの特徴的な形質をそなえていることがあきらかになったので、発見者の保田氏にちなみ、この集団にタカネセスジアカガネオサムシ subsp. *nobukii* という新亜種名を与えて記載した。本新亜種の生息地は、大雪山国立公園の特別保護区内にあるため、採集圧による個体数の減少が問題となることはないだろう。しかしながら、その生息地はわずか1.3ヘクタールの面積をもつに過ぎない孤立した湿原であり、また、同地のバルサの総面積は年ねん減少しているという。地球温暖化に伴うこうした環境条件の変化が、同地の希少な動植物相にも今後、少なからぬ影響を与えてゆくであろうことは明白で、こうした点を考慮に入れると、本新亜種は、絶滅の恐れのある地域個体群に匹敵する扱いがなされてもよいであろう。

## References

- FISCHER VON WALDHEIM, G., 1820–'22. Entomographia imperii Russici, I. viii+208 pp. Mosquae.
- GÉHIN, J. B., 1885. Catalogue synonymique et systématique des Coléoptères de la tribu des Carabides, avec des planches dessinées par Ch. HAURY. xxxviii+104 pp., 10 pls. Remiremont & Prague.
- IMURA, Y., 2002. Classification of the subtribe Carabina (Coleoptera, Carabidae) based on molecular phylogeny. *Elytra, Tokyo*, **30**: 1–28.
- KANDA, H., & K. SATO, 1994. An arctic moss, *Loeskytnum badium* (HARTM.) PAUL (Amblystegiaceae), new to Japan. *Hikobia, Higashi-hiroshima*, **11**: 429–433.
- KÔNO, H., 1936. Die Käfer-Fauna vom Daisetsu Gebirge. *Biogeographica, Tokyo*, **1**: 75–104. (In Japanese, with German title.)
- LAPOUGE, G. V. DE, 1913. Carabes nouveau ou mal connus. *Misc. ent.*, **21**(1): 1–241.
- REITTER, E., 1896. Bestimmungs-Tabelle der europäischen Coleopteren, Carabidae, I, Carabini, gleichzeitig mit einer systematischen Darstellung sammtlicher Subgenera der Gattung *Carabus* L. *Verh. naturf. Ver. Brünn*, **34**: 36–198.
- SATO, K., & N. TAKAHASHI, 1994. *Carex rotundata* WAHLENB. (Cyperaceae) from Mts. Daisetsu in Hokkaido, new to Japan. *J. Jpn. Bot.*, **69**: 235–238. (In Japanese, with English title.)
- SONE, T., 2002. Internal structure of a palsa in the bog to the south of Mt. Hiragatake, the Daisetsu Mountains, Hokkaido, Japan. *J. Geogr.*, **111**: 546–554.
- TAKAHASHI, N., & T. SONE, 1988. Palsas in the Daisetsuzan Mountains, central Hokkaido, Japan. *Geogr. Rev. Japan*, **61** (Ser. A)–9: 665–684. (In Japanese, with English title and summary.)
- WASHBURN, A. L., 1983. What is palsa? In POSER, H. (ed.), Mesoformen des heutigen Periglazialraumes (Geomorphologisches Symposium, Kehr bei Göttingen, 1982). *Proc., Göttingen Akad. Wiss.*, 34–47.
- YASUDA, N., 2001. Ground beetles communities of the high altitude zone in Mts. Daisetsu, Hokkaido. *Bull. Sounkyo Visitor Center*, (21): 1–26.